Review

Pelargonium sidoides - from ethnopharmacology to evidence-based medicine: a systematic review

Oksana Honchar [a b], Olha Mykhailenko [a c d 1], Olha Holovchenko [a], Victoriya Georgiyants [a] Show more

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Highlights

- *P. sidoides* used in South Africa's tradition for respiratory and digestive diseases.
- Broad metabolite profile includes 70+ compounds across root and aerial parts.
- Demonstrates broad pharmacological effects *in vitro* and *in vivo* studies.
- Clinical trials confirm efficacy in respiratory infections, including viral etiologies.
- *Pelargonium* extracts show good safety and tolerability in human use.

Background

Pelargonium sidoides DC. (Geraniaceae) has a long history of traditional use among indigenous peoples of Southern Africa for treating respiratory and gastrointestinal disorders. Its transformation into the modern pharmaceutical product Umckaloabo (EPs® 7630) exemplifies the transition from traditional medicine to evidence-based therapeutics.

Purpose

To provide a systematic analysis of *P. sidoides*, spanning from its botanical characteristics and ethnobotanical roots to its development as a regulated phytomedicine. The review focuses on the plant's unique phytochemical profile and provides a detailed synthesis of its molecular and systems-biological mechanisms of action, cultivation sustainability, and clinical efficacy in managing respiratory tract infections.

Study design and methods

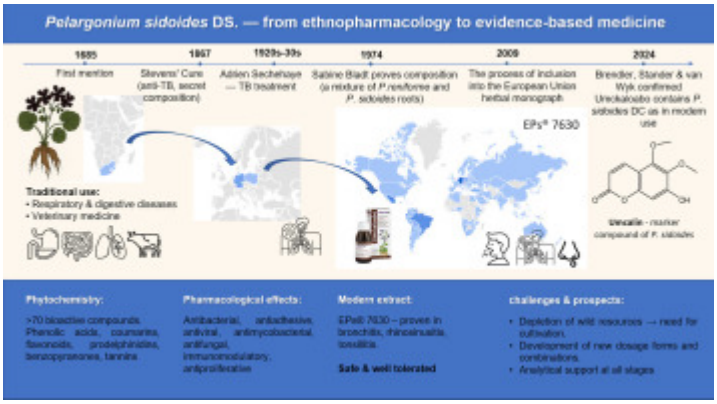
A systematic search was conducted across PubMed, Scopus, and Cochrane Library up to December 2025 following PRISMA guidelines. Sources included scientific articles, pharmacopoeias, patents, and ethnobotanical records in English and Ukrainian.

Results

The systematic synthesis of identified records characterizes the chemical diversity of *P. sidoides*, focusing on specialized metabolites such as highly substituted benzopyranones, prodelphinidins, and unique coumarin sulfates. The review discusses modern cultivation practices, sustainability issues, and comparative extraction techniques, while analytical methods such as HPLC, LC-MS, and TLC for standardization are summarized. The pharmacological profile is defined by multi-target activity, encompassing immunomodulatory, antibacterial, and antiviral effects, including studies on SARS-CoV-2 and other respiratory pathogens. Analysis of available clinical data validates the therapeutic use of *P. sidoides* root preparations for managing acute bronchitis, rhinosinusitis, and tonsillopharyngitis.

Conclusion

This study demonstrates that the integration of *P. sidoides* into modern healthcare is supported by the synergy between traditional knowledge and molecular and clinical validation. By mapping the developmental trajectory — from wild harvesting to systems-biological evidence — this review identifies *P. sidoides* as a model for the pharmaceutical trans**s**lation of ethnobotanical resources into standardized, evidence-based phytomedicines.



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Keywords

Pelargonium sidoides; Ethnopharmacology; Umckaloabo; umckalin, EPs® 7630; Stevens' Cure, acute respiratory tract infection

Abbreviations

AB, Acute Bronchitis; ARS/ABRS, Acute Rhino Sinusitis / Acute bacterial rhinosinusitis; ARTIs, Acute Respiratory Tract Infections; CNS, Central Nervous System; COPD, Chronic Obstructive Pulmonary Disease; DAD, Diode Array Detector; DER, Drug Extract Ratio; EMA, European Medicines Agency; ERK1/2, Extracellular signal-regulated kinases 1/2; HAB, Homeopathic Pharmacopoeia of Germany; HCoV-229E, Human Coronavirus 229E; HgCdTe, Mercury-Cadmium-Telluride Detector; HIV, Human Immunodeficiency Virus; HPTLC, High-Performance Thin-Layer Chromatography; HPLC, High-Performance Liquid Chromatography; HPLC-MS, High-Performance Liquid Chromatography – Mass Spectrometry; HSV, Herpes Simplex Virus; IFN-β/γ, Interferon-beta / gamma; IL-1, IL-12, Interleukin-1, Interleukin-12; iNOS, Inducible nitric oxide synthase; IR, Infrared Spectroscopy; LC, Liquid Chromatography; LC-QToF-MS, Liquid Chromatography–Quadrupole Time-of-Flight Mass Spectrometry; MAPK, Mitogen-activated protein kinase; MIC, Minimum Inhibitory Concentration; MS, Mass Spectrometry; Mtb, Mycobacterium tuberculosis; NF-? B, Nuclear factor kappa-light-chain-enhancer of activated B cells; NMR, Nuclear Magnetic Resonance; RCTs, Randomized Controlled Trials; RSV, Respiratory Syncytial Virus; sIgA, Secretory immunoglobulin A; SPU, State Pharmacopoeia of Ukraine; TNF-a, Tumor necrosis factor alpha; TNFAIP3, Tumor necrosis factor alpha-induced protein 3 (A20); UHPLC, Ultra-High-Performance Liquid Chromatography; UPLC-MS/MS, Ultra

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Introduction

The global market has begun to impose strict requirements on the quality and safety of phytotherapeutic products, partly due to the risks to consumer health associated with the use of falsified or contaminated products. Additionally, recent decades have witnessed a growing trend among patients to preferring natural medicinal products over synthetic pharmaceuticals (Lopes et al., 2018).

One such medicinal plant is *Pelargonium sidoides* DC., commonly known as the South African geranium, a perennial herbaceous plant belonging to the genus *Pelargonium* — one of seven genera (along with *Geranium, Erodium, Monsonia, Hypseocharis, Rhynchotheca*, and *Sarcocaulon*) within the Geraniaceae family, classified under the angiosperms, class Magnoliopsida, and order Geraniales (Brenes et al., 2024).

P. sidoides is the most extensively studied species, whose fleshy, bright red roots have been traditionally used by the Zulu and other indigenous peoples of Southern Africa for the treatment of tuberculosis, cough, and various pulmonary conditions, as well as for diarrhea, dysentery, infantile colic (Brendler and van Wyk, 2008), gastritis, liver diseases, algomenorrhea, and gonorrhea.

The therapeutic focus of modern *P. sidoides* root-based preparations has shifted from gastrointestinal to respiratory tract disorders, including acute bronchitis, asthma, sinusitis, and tonsillopharyngitis.

The main focus is on the research into the standardised aqueous-alcoholic extract of the root of *P. sidoides* (also known as EPs® 7630, manufactured in Germany by the phytopharmaceutical company Dr. Willmar Schwabe Pharmaceuticals), which is produced under various trade names, including Umckaloabo. EPs® 7630 has a well-characterised pharmacological profile, has been approved by the European Medicines Agency (EMA, 2022), and listed in the 11th edition of the European Pharmacopoeia. The State Pharmacopoeia of Ukraine (SPU) (second edition, volume 3) also has a monograph "*Pelargonium roots*".

P. sidoides is a plant that has long attracted the attention of scientists, with an extremely interesting historical and geographical path from its use in ethnopharmacology in South Africa, through the secret "Stevens' Cure", to a modern remedy with proven preclinical and clinical efficacy, which is used worldwide. While foundational reviews, such as the work by Kolodziej

aims to synthesize existing knowledge through a novel, systemic perspective. Our primary focus is on tracing the remarkable journey of the plant – from its ethnobotanical origins and the enigmatic “Stevens' Cure” to its modern embodiment as a standardized phytopharmaceutical (EPs® 7630), as well as other application forms, including the potential use of combination preparations, thereby presenting it as a model for evidence-based phytotherapy. Following PRISMA 2020 guidelines, this review aims to analyze current data on the botanical features of *P. sidoides,* its use in folk medicine, its distribution in nature, and the challenges associated with raw material procurement, as well as the potential to address these challenges through cultivation. Much attention is paid to the description of the plant's phytochemical composition, methods of extracting bioactive compounds, analytical techniques, pharmacological studies, systems-biological mechanisms, and medicinal application.

The review provides a critical assessment of these often-overlooked aspects, including the conservation status of wild populations, sustainable cultivation strategies, and analytical challenges in quality control, which are crucial for the plant's future sustainable use. A unique feature of our analysis is the integration of Google Trends data, which quantitatively assesses the growing global public interest in *P. sidoides*-based medicines worldwide from 2004 to 2025, reflected in the increase in search queries. This highlights the need for rational use of natural resources, plant cultivation, and improvement of quality control systems.

Drawing on extensive research into the historical context and ethnopharmacology of *P. sidoides*, this systematic review offers a holistic approach to the analysis of accumulated data. Given the inherent complexity of botanical entities, we view the pharmaceutical trajectory of *P. sidoides* as a multifaceted process where cultivation conditions and extraction technologies directly influence the phytochemical profile and, consequently, biological activity. This approach allows for tracing the plant's journey from traditional origins to the modern standardized preparation (EPs® 7630) through the lens of systems biology and the principles of evidence-based medicine. Beyond confirming the efficacy of *P. sidoides* in treating respiratory infections, it highlights the potential of 'returning to its roots'—such as investigating traditional applications for gastrointestinal disorders —representing a promising avenue for expanding the plant's therapeutic profile.